

# IOWA STATE UNIVERSITY

## Digital Repository

---

TSM 416 Technology Capstone Projects

Undergraduate Theses and Capstone Projects

---

4-2020

## Feed Batch Mixer Box for ISU Beef Nutrition Farm

Luke Sweeney

*Iowa State University, [sweeney1@iastate.edu](mailto:sweeney1@iastate.edu)*

Brennon Ryan

*Iowa State University, [brennonr@iastate.edu](mailto:brennonr@iastate.edu)*

Mark Thompson

*Iowa State University, [mthomp@iastate.edu](mailto:mthomp@iastate.edu)*

Luke Sinclair

*Iowa State University, [lukesin@iastate.edu](mailto:lukesin@iastate.edu)*

Michael Anderson

*Iowa State University, [mea1@iastate.edu](mailto:mea1@iastate.edu)*

*See next page for additional authors*

Follow this and additional works at: <https://lib.dr.iastate.edu/tsm416>



Part of the [Bioresource and Agricultural Engineering Commons](#), and the [Industrial Technology Commons](#)

---

### Recommended Citation

Sweeney, Luke; Ryan, Brennon; Thompson, Mark; Sinclair, Luke; Anderson, Michael; and Koziel, Jacek A., "Feed Batch Mixer Box for ISU Beef Nutrition Farm" (2020). *TSM 416 Technology Capstone Projects*. 67. <https://lib.dr.iastate.edu/tsm416/67>

This Report is brought to you for free and open access by the Undergraduate Theses and Capstone Projects at Iowa State University Digital Repository. It has been accepted for inclusion in TSM 416 Technology Capstone Projects by an authorized administrator of Iowa State University Digital Repository. For more information, please contact [digirep@iastate.edu](mailto:digirep@iastate.edu).

---

## Feed Batch Mixer Box for ISU Beef Nutrition Farm

### Problem Statement

The Iowa State Beef Nutrition Farm's mission is to provide facilities and support for research aimed at optimizing nutrition and management of beef cattle in Iowa. Facilities include a modern open-front, 60-pen feedlot, a 7-pen feedlot with an electronic feed intake management system, and a 16-pen open-front feedlot. All pen sizes are adequate for up to six animals. There are 120 acres of improved pasture available for grazing research and several small open lots with fence line feed bunks. A modern, indoor animal handling facility, feed mill and indoor and outdoor feed storage structures are on hand.

Our client, Jordan Harding, has tasked us with the goal of increasing efficiency and decreasing time spent feeding cattle daily. Currently, they are using multiple people to feed, and when the feed wagon is out feeding there is wasted downtime for the other workers. This downtime will be filled with our dumper in place. We hope to cut their daily feeding time down from 3 hours to 2 hours.

Our solution is to fill their downtime waiting on the feed wagon with a fillable hopper that can then dump into the feed wagon. Using the time that the feed wagon is actually feeding to mix the next ration will save them tremendous overall time and increase their efficiency drastically.

### Disciplines

Bioresource and Agricultural Engineering | Industrial Technology

### Authors

Luke Sweeney, Brennon Ryan, Mark Thompson, Luke Sinclair, Michael Anderson, and Jacek A. Koziel

**Department of Agricultural and Biosystems Engineering (ABE)**

**TSM 416 Technology Capstone Project**

# Feed Batch Mixer Box for ISU Beef Nutrition Farm

**Luke Sweeney <sup>a</sup>, Brennon Ryan <sup>b</sup>, Mark Thompson <sup>c</sup>, Luke Sinclair <sup>d</sup>, Michael Anderson <sup>e</sup> and Jacek A. Koziel <sup>f</sup>**

<sup>a</sup> Agricultural Systems Technology, ABE, ISU, [sweeney1@iastate.edu](mailto:sweeney1@iastate.edu)

<sup>b</sup> Agricultural Systems Technology, ABE, ISU, [brennonr@iastate.edu](mailto:brennonr@iastate.edu)

<sup>c</sup> Agricultural Systems Technology, ABE, ISU, [mthomp@iastate.edu](mailto:mthomp@iastate.edu)

<sup>d</sup> Industrial Technology, ABE, ISU, [lukeisin@iastate.edu](mailto:lukeisin@iastate.edu)

<sup>e</sup> Dept. of Agricultural and Biosystems Engineering, ISU, 2358 Elings Hall, Ames, IA 50011, [mea1@iastate.edu](mailto:mea1@iastate.edu), 515-294-2129

<sup>f</sup> Dept. of Agricultural and Biosystems Engineering, ISU, 4350 Elings Hall, Ames, IA 50011, [koziel@iastate.edu](mailto:koziel@iastate.edu), 515-294-4206

\*course instructors and corresponding authors.

**Client:** Iowa State Beef Nutrition Farm, 3405 North Dakota Ave, Ames, IA, 50014

- Contact(s): Jordan Harding, Beef Nutrition Farm Manager, [jharding@iastate.edu](mailto:jharding@iastate.edu), (515)290-4025; Jeff Thorson, Animal Caretaker, [thorson@iastate.edu](mailto:thorson@iastate.edu), (515)290-4025

## 1 PROBLEM STATEMENT

---

### Problem Statement

The Iowa State Beef Nutrition Farm's mission is to provide facilities and support for research aimed at optimizing nutrition and management of beef cattle in Iowa. Facilities include a modern open-front, 60-pen feedlot, a 7-pen feedlot with an electronic feed intake management system, and a 16-pen open-front feedlot. All pen sizes are adequate for up to six animals. There are 120 acres of improved pasture available for grazing research and several small open lots with fence line feed bunks. A modern, indoor animal handling facility, feed mill and indoor and outdoor feed storage structures are on hand.

Our client, Jordan Harding, has tasked us with the goal of increasing efficiency and decreasing time spent feeding cattle daily. Currently, they are using multiple people to feed, and when the feed

Department of Agricultural and Biosystems Engineering ([abe@iastate.edu](mailto:abe@iastate.edu)) aims to be a premier team serving society through engineering and technology for agriculture, industry and living systems. ABE welcomes opportunities to discover and improve new technologies for all stakeholders. 1

wagon is out feeding there is wasted downtime for the other workers. This downtime will be filled with our dumper in place. We hope to cut their daily feeding time down from 3 hours to 2 hours.

Our solution is to fill their downtime waiting on the feed wagon with a fillable hopper that can then dump into the feed wagon. Using the time that the feed wagon is actually feeding to mix the next ration will save them tremendous overall time and increase their efficiency drastically.

## 2 MAIN OBJECTIVE

---

- A. Finding the root cause for spending too much feeding the cattle.
- B. We will measure the time it takes to feed prior to the dump box and then while using the dump to see the time difference.
  - The specific parameters that were measured were time spent loading, mixing, and feeding.
  - reduced feeding time as well as improved feeding efficiency

### **Main Objective(s) and Specific Objectives**

- The main objective is to reduce the time spent feeding cattle by having the next batch of feed ready to be mixed.

### **Specific objectives include:**

- *The first prototype completed by Feb. 15, 2020*
- *Must be able to hold 92 ft<sup>3</sup>*
- *The budget of \$1500 for material*
- *Must be able to dump feed into RotoMix feed wagon*
- *Must be able to function in the current feed room*

### **Rationale**

- *Reduce time feeding cattle*
- *Efficiently load and unload the batch box*
- *Have the next batch of feed ready to mix*
- *Time on weekends spent feeding reduced*

### **Project Scope**

*Our scope is to fabricate the existing hydraulic dump box to be able to hold feed and cut feeding time down.*

- Our scope has changed throughout the semesters. We have had new items come into play as well as items removed.
- The manager noticed that they were spending too much time feeding.
- The scale that will be used doesn't have to be bought now as they will be utilizing the previous scale from the cattle chute.

## 3 METHODS/APPROACH

---

### **Reference Material(s)**

- Vestil Hydraulic Dump Box drawing, measurements, and time studies were used.

Department of Agricultural and Biosystems Engineering ([abe@iastate.edu](mailto:abe@iastate.edu)) aims to be a premier team serving society through engineering and technology for agriculture, industry and living systems. ABE welcomes opportunities to discover and improve new technologies for all stakeholders. 2

**Data collection:**

- We collected time trials between the current processes and the use of the dump box

**Skills:**

- ABE 271, TSM 240, 214
- Agricultural and fabrication backgrounds to understand, then complete the project.

**Solutions:**

- To create a system that improves feeding time efficiency on a daily basis.
  - The solution should decrease the time spent feeding by several minutes.
  - Modification of a dump box that was not in use on the farm
  - Reuse of their cattle chute scale system.
  - The first prototype was done by Feb. 15, 2020.

**Organization:**

We communicated as a group throughout each semester and during university breaks while keeping the client in the loop of progress and ideas we had for the project. The use of our weekly reports helped us to keep on track and hold group members accountable for their tasks each week. With the understanding that each of us has our own schedules, working on our own and finding time to go out to the farm to work varied on a weekly basis, which worked in favor of the group. This allowed the team to choose the tasks that were required during that week to allow us to complete each milestone. The major milestones of this project were the design of the new system, ordering of parts and materials, fabrication of the Vestil Dump Box, and lastly, the verification and data collection of the design. The project had a due date of Feb. 15 which required us to adjust when each milestone was due for us to complete the project on time.

## 4 RESULTS

---

**Results/Deliverables**

- Good (equivalent to grade C):
  - Weighs accurately
  - Can load Rotomix feed wagon
  - No sweeping/cleanout required
  - No modification to current feed room structures
- Very good (equivalent to grade B):
  - All deliverables from the above list
  - The first prototype completed by Feb. 15, 2020
- Excellent (equivalent to grade A)
  - All deliverables from both above lists
  - Remote controlled
  - Painted to match the existing machine
  - The first prototype was done by the start of the spring semester
- Results
  - With the completion and installation of the Batch Box, overall feeding times were cut by 30-60 minutes a day.

**Recommendations**

Department of Agricultural and Biosystems Engineering ([abe@iastate.edu](mailto:abe@iastate.edu)) aims to be a premier team serving society through engineering and technology for agriculture, industry and living systems. ABE welcomes opportunities to discover and improve new technologies for all stakeholders. 3

- Weld an extension piece to
- Add a wireless controller to improve the dumping time.

## 5 BROADER OPPORTUNITY STATEMENT

---

Our solution is quite simple but will make a positive difference on time it takes to feed all the cattle each day. While it may not be appealing to the average person due to it being an agriculture problem, everyone can appreciate the idea of saving time. Every year gets more challenging for the world of agriculture. Our project addresses this problem by allowing fewer people to get more done in a shorter amount of time. This same solution can be used by other areas of agriculture as well as the manufacturing sector. The problem of saving time or doing more with fewer people is a huge topic for any type of business and is one of the top three problems businesses are constantly working. Although it didn't fit our project, robots are one of the most recent answers to this problem.

## 6 GRAPHICAL ABSTRACT

---

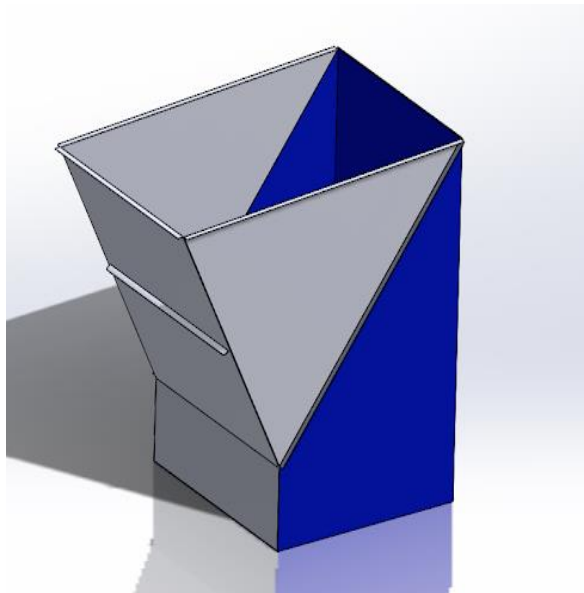


Figure 1: Original Solidworks Design



Figure 2: Final Installed Product

## 7 REFERENCES

---

Vestil Manufacturing Corp. *HBD-2-60Vestil*. 2011. PDF. (<https://www.vestil.com/page-drawings.php>)

Department of Agricultural and Biosystems Engineering ([abe@iastate.edu](mailto:abe@iastate.edu)) aims to be a premier team serving society through engineering and technology for agriculture, industry and living systems. ABE welcomes opportunities to discover and improve new technologies for all stakeholders. 4

## 8 APPENDIXES

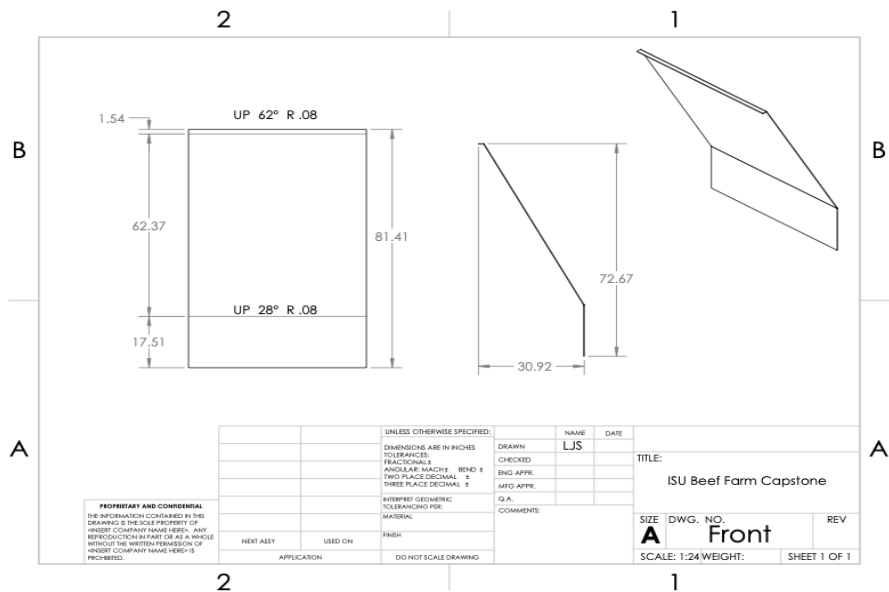


Figure 2: Front Side Panel

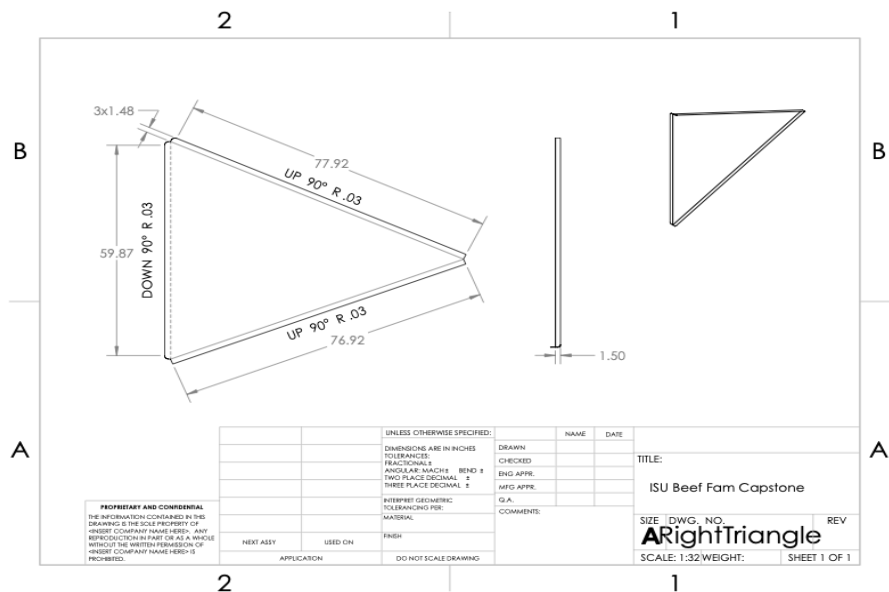


Figure 3: Right Side Panel

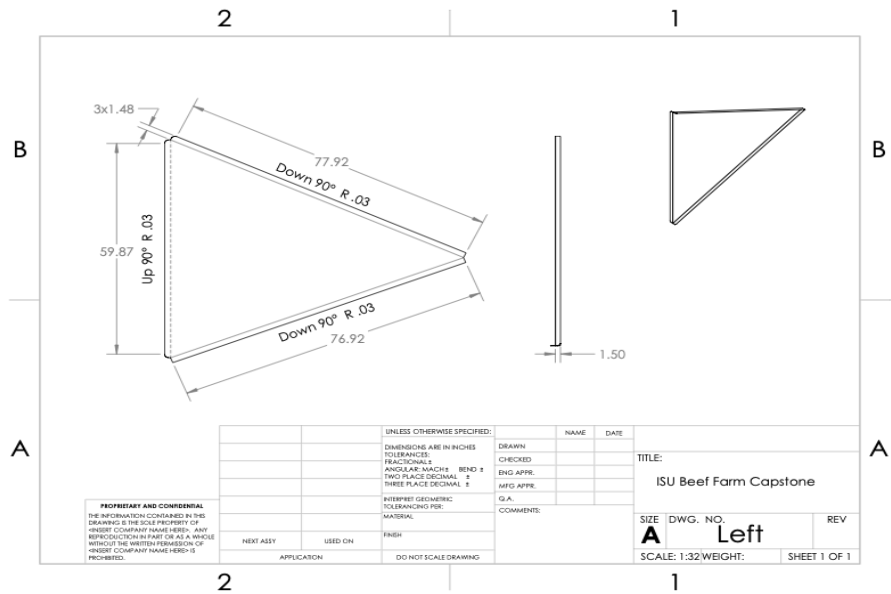


Figure 4: Left Side Panel